

The claims:

1. A method for fabrication of a light emitting device on substrate, the light emitting device having a wafer with multiple epitaxial layers and a first ohmic contact layer on the epitaxial layers remote from the substrate; the method including the steps:
 - (a) applying to the ohmic first contact layer a seed layer of a thermally conductive metal;
 - (b) electroplating a relatively thick layer of the thermally conductive metal on the seed layer; and
 - (c) removing the substrate.
2. A method as claimed in claim 1, wherein the first ohmic contact layer is coated with an adhesion layer prior to application of the seed layer.
3. A method as claimed in claim 1 or claim 2, wherein the seed layer is patterned with photoresist patterns before the electroplating step (b).
4. A method as claimed in claim 3, wherein the electroplating of the relatively thick layer is between the photoresist patterns.
5. A method as claimed in any one of claims 1 to 4, wherein between steps (b) and (c) there is performed the additional step of annealing the wafer to improve adhesion
6. A method as claimed in claim 3 or claim 4, wherein the photoresist patterns are of a height of at least 50 micrometers.
7. A method as claimed in claim 3 wherein the photoresist patterns have a thickness in the range 3 to 500 micrometers.
8. A method as claimed in any one of claims 3, 4, 6 and 7, wherein the photoresist patterns have a spacing of 300 micrometers.
9. A method as claimed in any one of claims 1 to 8, wherein the seed layer is electroplated in step (b) without patterning, patterning being performed subsequently.

10. A method as claimed in claim 9, wherein patterning is by photoresist patterning and then wet etching.
- 5 11. A method as claimed in claim 9, wherein patterning is by laser beam micro-machining of the relatively thick layer.
12. A method as claimed in any one of claims 3 to 11, wherein the relatively thick layer is of a height no greater than the photoresist height.
- 10 13. A method as claimed in any one of claims 3 to 11, wherein the relatively thick layer of thermally conductive metal is electroplated to a height greater than the photoresist and is subsequently thinned.
- 15 14. A method as claimed in claim 13, wherein thinning is by polishing.
15. A method as claimed in any one of claims 1 to 14, wherein after step (c) there is included an extra step of forming on a second surface of the epitaxial layers a second ohmic contact layer, the second ohmic contact layer being selected from the group consisting of: opaque, transparent, and semi-transparent.
- 20 16. A method as claimed in claim 15, wherein the second ohmic contact layer is one of blank and patterned.
- 25 17. A method as claimed in claim 15 or claim 16, wherein bonding pads are formed on the second ohmic contact layer.
18. A method as claimed in any one of claims 1 to 14, wherein after step (c) ohmic contact formation and subsequent process steps are carried out, the subsequent process steps including deposition of wire bond pads.
- 30 19. A method as claimed in claim 18, wherein the exposed epitaxial layer is cleaned and etched before the second ohmic contact layer is deposited.

20. A method as claimed in any one of claims 15 to 19, wherein the second ohmic contact layer does not cover the whole area of the second surface of the epitaxial layers.
- 5 21. A method as claimed in any one of claims 15 to 20, wherein after forming the second ohmic contact layer there is included testing of the light emitting devices on the wafer.
- 10 22. A method as claimed in any one of claims 15 to 21, wherein there is included the step of separating the wafer into individual devices.
- 15 23. A method as claimed in any one of claims 1 to 22, wherein the light emitting devices are fabricated without one or more selected from the group consisting of: lapping, polishing and dicing.
24. A method as claimed in any one of claims 1 to 23, wherein the first ohmic contact layers are on p-type layers of the epitaxial layers.
- 20 25. A method as claimed in any one of claims 15 to 22, wherein the second ohmic contact layer is formed on n-type layers of the epitaxial layers.
- 25 26. A method as claimed in any one of claims 1 to 14, wherein after step (c), dielectric films are deposited on the epitaxial layers and openings are cut in the dielectric films and second ohmic contact layers and bond pads deposited on the epitaxial layers.
- 30 27. A method as claimed in any one of claims 1 to 14, wherein after step (c), electroplating of a thermally conductive metal on the epitaxial layers is performed.
28. A method as claimed in any one of claims 1 to 27, wherein the thermally conductive metal comprises copper and the epitaxial layers comprise multiple GaN-related layers.
- 35 29. A light emitting diode fabricated by the method of any one of claims 1 to 28.

30. A laser diode fabricated by the method of any one of claims 1 to 28.
31. A light emitting device comprising epitaxial layers, a first ohmic contact layer on a first surface of the epitaxial layers, a relatively thick layer of a thermally conductive metal on the first ohmic contact layer, and a second ohmic contact layer on a second surface of the epitaxial layers; the relatively thick layer being applied by electroplating.
32. A light emitting device as claimed in claim 31, wherein there is an adhesive layer on the first ohmic contact layer between the first ohmic contact layer and the relatively thick layer.
33. A light emitting device as claimed in claim 32, wherein there is a seed layer of the thermally conductive metal between the adhesive layer and the relatively thick layer.
34. A light emitting device as claimed in any one of claims 31 to 33, wherein the relatively thick layer is at least 50 micrometers thick.
35. A light emitting device as claimed in any one of claims 31 to 34, wherein the second ohmic contact layer is a thin layer in the range of from 3 to 500 nanometers.
36. A light emitting device as claimed in any one of claims 31 to 35, wherein the second ohmic contact layer is selected from the group consisting of: opaque, transparent, and semi-transparent.
37. A light emitting device as claimed in any one of claims 31 to 36, wherein the second ohmic layer includes bonding pads.
38. A light emitting device as claimed in any one of claims 31 to 37, wherein the thermally conductive metal is copper and the epitaxial layers comprise multiple GaN-related epitaxial layers.
39. A light emitting device as claimed in any one of claims 31 to 38, wherein the light emitting device is selected from the group consisting of: a light emitting diode, and a laser diode.

40. A light emitting device as claimed in any one of claims 31 to 39, wherein the first ohmic contact layer, at its interface with the epitaxial layers, is a mirror.
- 5 41. A light emitting device comprising epitaxial layers, a first ohmic contact layer on a first surface of the epitaxial layers, an adhesive layer on the first ohmic contact layer, a seed layer of a thermally conductive metal on the adhesive layer, and a relatively thick layer of the thermally conductive metal on seed layer; the first ohmic contact layer, at its interface with the epitaxial layers, is a mirror.
- 10 42. A light emitting device as claimed in claim 41, wherein the relatively thick layer is one or more selected from the group consisting of: a heat sink, an electrical connector, and a mechanical support.
- 15 43. A light emitting device as claimed in claim 41 or claim 42, further including a second ohmic contact layer on a second surface of the epitaxial layers; the second ohmic contact layer being a thin layer in the range of from 3 to 500 nanometers.
- 20 44. A light emitting device as claimed in any one of claims 41 to 43, wherein the second ohmic contact layer comprises bonding pads and is selected from the group consisting of : opaque, transparent, and semi-transparent.
- 25 45. A light emitting device as claimed in any one of claims 41 to 44, wherein the thermally conductive metal comprises copper; and the epitaxial layers comprise GaN-related layers.
- 30 46. A light emitting device as claimed in any one of claims 41 to 45, wherein the light emitting device is one of: a light emitting diode and a laser diode.
47. A method of fabrication of a light emitting device, the method including the steps:
- 35 (a) on a substrate with a wafer comprising multiple GaN-related epitaxial layers, forming a first ohmic contact layer on a first surface of the wafer;

- (b) removing the substrate from the wafer, and
- (c) forming a second ohmic contact layer on a second surface of the wafer, the second ohmic contact layer having bonding pads formed thereon.

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48. A method as claimed in claim 47, wherein the second ohmic contact layer is for light emission, and is selected from the group consisting of: opaque, transparent, and semi-transparent.

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49. A method as claimed in claim 47 or claim 48, wherein the second ohmic contact layer is one of: blank, and patterned.

50. A light emitting device fabricated by the method of any one of claims 47 to 49.

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51. A light emitting device as claimed in claim 50, wherein the light emitting device is selected from the group consisting of: a light emitting diode, and a laser diode.